# SUPER BLINKY
SMT PRACTICE KIT

Ramsey Electronics Model No.   SBRGB

Get your surface mount practice on this nifty little kit! When assembled, the RGB full color LED will cycle through an array of mesmerizing colors! Makes for an excellent attention getter or name badge light like no other!

- **Bright full-color LED (not a single white element) with independently drivable red, green and blue LED elements. These elements are matched for a true "white" output or any color in between!**

- **Uses PWM methods to select any color with a simple 8-pin micro-controller. Switch-able speed selection and transition mode as well!**

- **Get your feet wet with surface mount technology on this fun little project, not one that's too complicated or too expensive. Build several and give them to your friends!**

- **Very small PC board for easy placement of this attention getter almost anywhere!**

- **Operates from 6V to 12VDC, includes a 9V battery snap!**

- **Kit even includes a few extra SMT parts in case you loose some!**

- **Clear, concise instructions to guide you step-by-step to a finished product that works the FIRST time!**
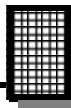
PARTIAL LIST OF AVAILABLE KITS
RAMSEY TRANSMITTER KITS
- **FM100 Professional FM Stereo Transmitter**
- **FM25B Synthesized Stereo Transmitter**
- **AM1, AM25 AM Transmitters**
- **TV6 Television Transmitter**

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- **AR1 Aircraft Band Receiver**
- **SR2 Shortwave Receiver**
- **AA7 Active Antenna**
- **SC1 Shortwave Converter**

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- **SP1 Speakerphone**
- **WCT20 Wizard Cable Tracer**
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- **IG7 Ion Generator**
- **CT255 Compu Temp Digital Binary Thermometer**
- **LC1 Inductance-Capacitance Meter**

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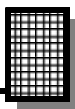
KIT ASSEMBLY
AND INSTRUCTION MANUAL FOR

SUPER BLINKY SURFACE MOUNT PRACTICE KIT

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INTRODUCTION

The Super Blinky was thought up as a way to show off the latest technology in RGB (Red, Green, Blue) color LEDs. These babies have always been tempting to play with in order to see just how many colors they could reproduce. The problem was that the darned RGB LEDs were so expensive (the Boss just about had a heart attack). Some of these LEDs cost more than $19.00 a piece as of the writing of this manual. They use the latest technology to achieve an incredibly bright output and are well worth the cost in some applications. From a kit point of view however, they are way too expensive! When the datasheet became available for the LED we're using and the pricing turned out to be much more reasonable then those we had looked at before, I knew the time had come!

So how did I get around the Boss you may ask? I turned this into a surface mount practice kit that met the requirements so many of you were asking for via the web. It contains a few simple and some challenging parts to work with (but not so complicated that you are left with a headache and a strong desire to give up and go watch TV). Not to mention after your done, you get a nice reward when it works right off the bat!

Personally I could stare at this color changing LED for a long time. In fact, the Boss thinks that's all I have been doing lately! Some of the colors the SBRGB produces are quite amazing. The red portion is a very deep color, to the point that it almost irritates the eye. When combined with the deep blue, it makes for a fantastic violet. Now add in the high intensity green into the mix and you have some pretty cool colors. Ok, now how do I get these colors to change?

On to the next section…

CIRCUIT DESCRIPTION

In the old days, we used to make things as simple as possible. The original blinky used two transistors, two capacitors and four resistors. This simple circuit is now seen everywhere in blinky kits so we decided to use a new and novel approach with this one. Our new blinky kit requires over 20,000 transistors, three capacitors, five resistors, and a few other parts. The difference is we can make the LED do **anything** we want, well almost anything.

The part which does most of the work is an 8-pin PIC micro-controller chip. Frankly these little things are amazing. They are perfectly suited to perform small tasks like this one. They are fast, easy to program, and require almost no external components to make them function. The PIC controller is programmed to pulse width modulate each of the 3 colors in various duty cycles to achieve the variety of colors we are looking for. What to we mean by pulse width modulate?

Pulse width modulation means that we are changing the percentage of on time vs. off time in a known amount to achieve a specific brightness. In our case we are pulsing width modulating with a resolution of 256 steps for each color. This means we have a resolution of 256*256*256 = 16,777,216 colors! We may not actually achieve this number due to limitations on switching speed, but we'll still get more than your eye can discern.

Now, let's say we want the red LED at 50% of full brightness. The red element needs to turn on and off in equal amounts fast enough that our eye cannot see it blink. How is this done in code? If you are familiar with PIC, here is a snippet:

```
toploop:                           ;Make the RED led turn on at 50% brightness.
        clrf    pace               ;For the full 256 counts
        movlw   0x7F               ;50%, leave red on for this many counts of 256
        movf    red                ;Into the red register
        bsf     GPIO,RED           ;Turn on the Red LED
pwmloop:
        decfsz  red,F              ;Decrement the red register
        goto    reds               ;If red not at zero, leave the Red LED on
        bcf     GPIO,RED           ;If red at zero, turn the Red LED off

reds:   decfsz  pace,F             ;Decrement the pace
        goto    pwmloop            ;If not at zero, keep looping until 256 counts done.
        goto    toploop            ;Continue on, or loop to toploop
```

Ok, so you may not have done much assembly programming before. This is a real neat example to help you learn what assembly code can do. The best way to read this code is to look at the text after the semicolons (here is where the descriptive information resides). The text on the far left are labels that identify points in the program flow where you may whish the program to start from or jump to (remember Basic's goto 10? 10 was a label for a line).

All that this example code does is to set the Red LED at 50% brightness. If we wanted to change it to 25% brightness, we would change line 2 to:

```
movlw   0x40              ;25% (256/4 = 64 base10 = 40 HEX)
```

Now imagine that we vary the percentage value in real time using a variable rather than a constant of 0x40 (HEX numbering system). On top of this, use a Sine lookup table to produce smooth changes. When we apply these principles to all three color elements in the LED at random, you get the Super Blinky!

So how would you achieve an orange color with the SBRGB? First you would figure out what percentage of each color needs to be on to produce orange. From the choices of Red, Green and Blue, Orange resides somewhere between Green and Red. Mostly towards Red end. This means Red will be at a full 100% duty cycle (255), Green will be around 50% (127), and Blue will be off at 0% (0).

RED

GREEN
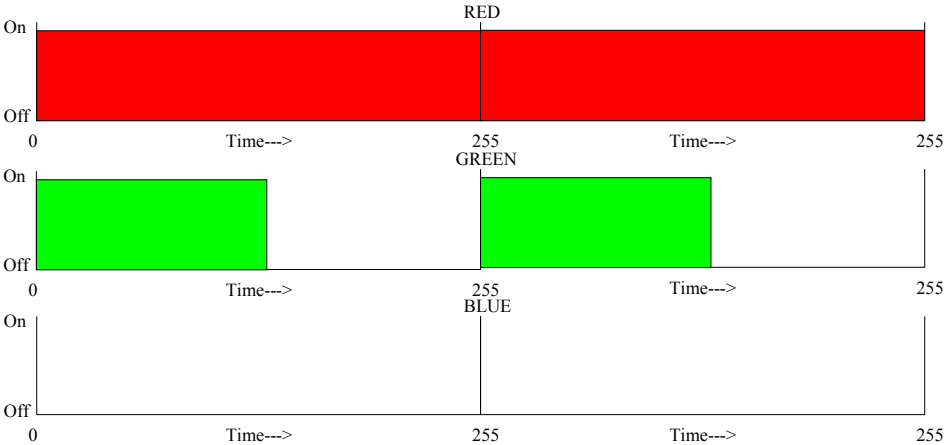
BLUE

How about a nice violet color?

RED
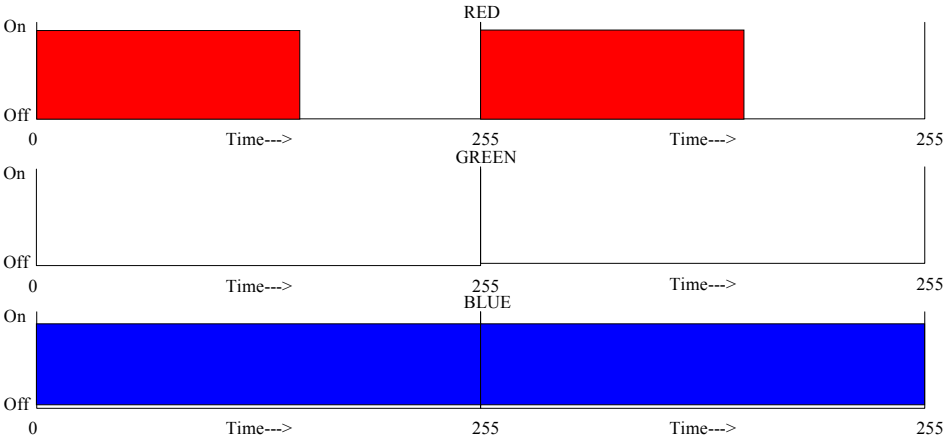
GREEN

BLUE

As shown, violet is created mostly by blue with some red. If you own a computer, you can try these shades out by changing your display properties and custom selecting a color. It will allow you to enter color values in Red, Green, and Blue in a range of 0-255 just like the Super Blinky!

The timing charts only show a small percentage of the overall PWM waveform. To keep the LEDs from appearing to blink, we have to keep them flashing at a rate faster than our eye can see (at least 30 times a second). Right now we are flashing at a rate of 280 times a second so it's more than fast enough.

If we want to fade from white to blue, the trick is to fade at a reasonable rate of speed according to our 280 times a second flash rate. To fade from white to blue in one second, we need to start with 255 and then subtract one from both red and green value once per cycle (skip a few cycles in between to stretch the time a bit). At the end of 280 cycles, the red and green element drive rate is at zero and blue is left completely on.
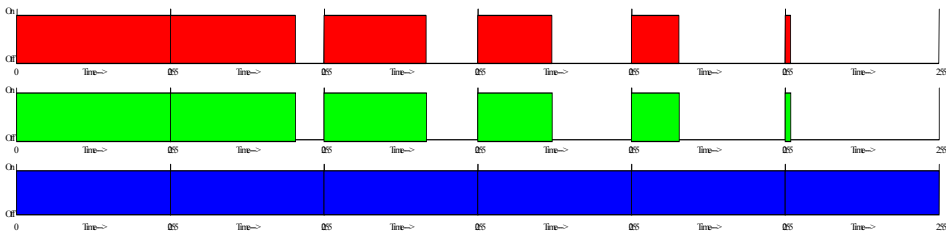
The Super Blinky actually gets a bit more complicated than this in order to achieve the eye pleasing color changes in uneven sinusoidal steps (versus the examples linear ones). This is accomplished with lookup data tables.

The rest of the circuit consists of the power supply and the LED itself. The power supply is a simple 5V regulator that is required to keep the supply voltage to the micro-controller at +5V (it cannot handle more than that). Unfortunately the Super Blinky will not operate at +3V with a lithium button cell (though two cells will do) since the blue element of the LED requires at least 4.0V before it will even turn on. The circuit will run, but no blue LED!

Take a look at the following specification sheet on the provided LED. Notice the forward voltages required to turn on the individual elements in the Vf = V typ column and the relative intensity when looking straight into the LED in Iv = mcd typ column (mcd is intensity in mili-candelas). Mili-candelas are deceiving in that they only tell you how bright an LED is from a certain perspective. We are using a diffused lens so the number is much lower than with a water-clear lens that would focus all the light in a narrower beam. Same LED, different lens, higher numbers! Lens selection all depends on your application. The diffused style is used here to ensure a maximum viewing radius.

Another interesting point to note is that for this LED to have enough green content to match up with the blue and the red components, two elements were needed! To achieve a good quality white color, we have to provide the proper current from the driver for each color element. Here is the key to the values chosen for resistors R1, R2, and R3. We want 20 mA, 40 mA, and 20 mA in each of the Red, Green, and Blue elements respectively to get a good white when fully on. After experimenting a bit, we decided to change the scaling to 5 mA, 60 mA, and 10 mA to obtain a nice vivid green and a brighter white without changing the overall brightness. The low duty cycle ('on' time) still yields a low average current so the slightly higher drive will not harm the green elements.

LED COLOR	Lens Type / Color	Electrical-Optical Characteristics (Ta=25C)				Full Viewing Angle
		If = mA typ	Iv = mcd typ	Vf = V typ	Ip nm	
UL RED	DIF-FUSED	20	20	1.7	660	
HE GREEN		40	30	2.0	565	
UL BLUE		20	6	4.0	430	

PARTS SUPPLIED WITH THE SUPER BLINKY KIT: Note a few extra chip parts included.

Capacitors
- ☐ 2 0.1 µF chip capacitor (no marking, usually brown) [C1]
- ☐ 2 1 µF electrolytic surface mount capacitors (Silver, marked 1 µF) [C2,C3].

Resistors
- ☐ 4 10K ohm resistors (Marked 103 on black side) [R5,6]
- ☐ 2 680 ohm resistors (Marked 681 on black side) [R1]
- ☐ 2 51 ohm resistors (Marked 510 on black side) [R2]
- ☐ 2 100 ohm resistors (Marked 101 on black side) [R3]

Semiconductors
- ☐ 1 78L05 Voltage regulator in an SO-8 package. [VR1]
- ☐ 1 PIC12C509SN Micro-controller in an SO-8 package. [U1]
- ☐ 1 RGB Full Color LED (DS-1024-105A) [D1]
- ☐ 1 1N4148 Type switching Diodes (3-pin SOT-23 packages) [D3]

Hardware, Misc.
- ☐ 1 9V Battery Clip
- ☐ 2 2 Pin header for mode selection [J1,2]
- ☐ 2 Jumper Block for 2 Pin header
- ☐ 1" #24 AWG Buss wire [optional power configuration jumper]
- ☐ 1 SB-RGB PC board

Required, not supplied
- ☐ 9V Battery

Required Tools
- ☐ Small-tipped soldering iron, usually called a pencil iron. Call Ramsey for more details or to order a soldering iron capable of surface mount if you do not have one.
- ☐ Eye Loupe
- ☐ Pair of tweezers
- ☐ Length of very thin solder
- ☐ Patience, it counts as a tool.
- ☐ A stand or kit vise to solidly hold the board while assembling.

SBRGB ASSEMBLY

Use the boxes to check off your progress as you go along.

Check all received parts against the Parts list. The parts list describes the various markings that may be found on the kit parts.

In the case of a surface mount component, INSTALL means these steps:
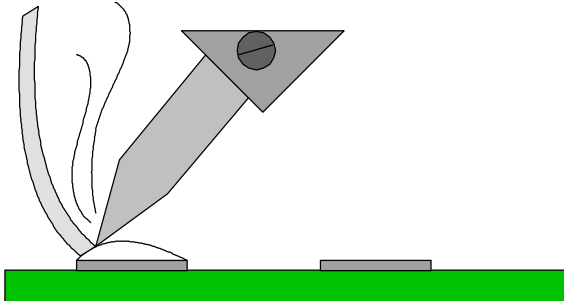
- Dab a small amount of solder on one pad of the PC board for the component you wish to install. Usually choose pin 1.

- Locate the appropriate part from those packed in the kit.
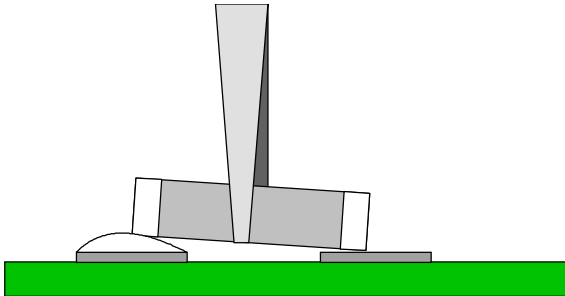
- Use tweezers to pick up the part by grabbing it across the body, not the solder connections.

- Place the part in the assembly location as noted by the silk-screen on the top layer of the board (the bottom side has no writing on it). Use one hand to hold the tweezers and part in place.
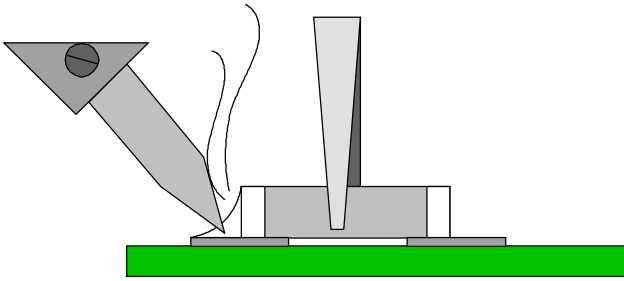
- Use the other hand to re-heat the solder dab to melt it to the component connection.

- Let the solder cool and then let go with the tweezers. Inspect orientation and make sure the part is square over the correct pads. Make sure stray solder connections don't overlap or short across the adjacent pads.

- Apply solder to the rest of the pads.
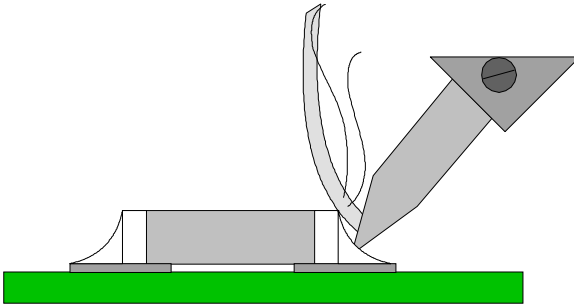
- Apply a touch more solder to the initial pad to make sure there is a good solder joint. The rosin core flux will clean the joint and insure stability.

- If you have too much solder and wish to remove it, use a solder sucker or solder wick to "soak up" the extra solder. Solder bridges on SMT IC pins are a frequent occurrence so you should always have some solder wick handy.

In the case of through hole components:

- Insert the part (oriented correctly) into its holes or pads on the PC board.

- If helpful, gently BEND the parts wire leads or tabs to hold it in to make soldering easier.

- SOLDER ALL wires or pins of the part. Whether it's two wires or pads of a resistor or all pins or pads of an IC socket.

- Nip or "trim" all excess wires extending beyond each solder connection. Take care that wire trimmings do not become lodged in PC board solder connections.

Enough said. . . Let's get building!

You are going to want to use a VERY clean desk space to assemble your surface mount kit. Drop a resistor into even the smallest amount of clutter and it will disappear like magic. You would swear a magician was hovering over your shoulder some times when a part disappears. There are probably enough parts hidden in the papers on my desk to build an entire communications system, but we won't go there… the Boss might read this!

While building, select only one surface mount part at a time. Don't pour them out all over the desk! Retrieve a single component (I wet my finger a bit to have a part stick to it) and place the part in the open work area of your desk. This makes it easier to pick it up with the tweezers and orient the part so the markings are on the top for easier trouble shooting if needed. It also provides me with Tidily Winks practice; *Ping* and I hear the part bounce off of the other wall and down into the heat register. Hence the extra parts! If you are really careful, this won't happen to you.

☐ 1. We will begin with a few resistors first. Locate and install R6, the 10K ohm resistor (marked 103); see SBRGB Assembly for surface mount tips and don't worry, we've included extra resistors in case one should fly off.

☐ 2. Install R5, the other 10K ohm resistor (marked 103).

☐ 3. Install R3, a 100 ohm resistor (marked 101).

☐ 4. Install D3, the 1N4148 diode in a three pin black package. This package style is called an SOT-23 which actually covers more than just one pin layout style. You can have an SOT-23 with 3 pins or 5 so it can get confusing at times. This diode is used to protect your circuit in case the battery power is accidentally installed backwards.

☐ 5. Locate U1, the pre-programmed micro-controller. Note the dimple on the top side of the part labeled PIC12C509SN, this indicates pin 1 of the IC. Look at the silkscreen on the circuit board and find the notch to help you position the IC correctly. Pre-tin the circuit board by dabbing some solder on the pad where pin 1 will be placed. Position the part with your tweezers and solder pin 1 of the IC to the pad. Position the part so that all eight leads line up properly and stay centered over all eight pads to avoid shorting pins together.

Time to make a few decisions. Your SBRGB can be configured in a few different ways depending on how you want to use it. Things such as the operating voltage (6 VDC or any range from 7 to 12 VDC) and the optional positioning of D1, J1, and J2 (top or bottom side of the board) will determine which steps you will now follow. Here are your choices:
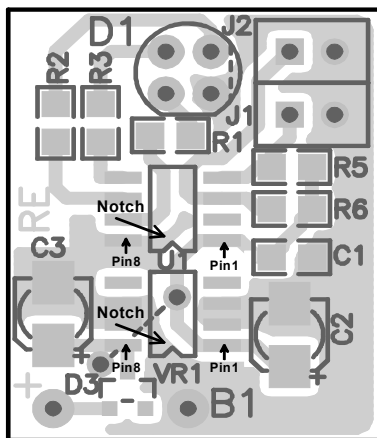

POWER SUPPLY (<u>A</u> for 6VDC, <u>B</u> for 7 to 12VDC operation)

❒ 6<u>A</u>. <u>6 Volt power source</u> (such as two 3 Volt lithium cells). Do not install VR1. Use the provided piece of buss wire as a jumper to connect from the output of D3 (pin 1 input of VR1) to the input of U1 (pin 8 output of VR1). This bypasses the voltage regulator on the bottom side of the board (no silkscreen) and allows lower voltage operation. Clip off any excess wire after it is soldered in place. Note the dashed line on the top silkscreen side indicates this optional configuration when VR1 is not used.

<div align="center">OR</div>

❒ 6<u>B</u>. <u>9 Volt power source</u> (7 to 12 VDC), install the 78L05 voltage regulator (VR1). Again, pay close attention to the small dimple in one corner of the IC used to indicate pin 1. There are a few different conventions used in the industry to note the pin-out of ICs but there should be a notch or a obvious mark to make things easy to work with. If there is no notch then refer to the diagram below for the position of pin 1. Pins are always counted from the lower left of the IC when you can read the writing on it. Align pin one as before with U1 and mount it in the same fashion.
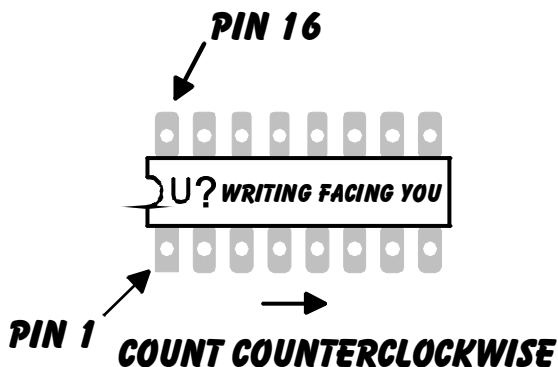
OPTIONAL LED POSITIONING (A for Bottom side, B for Top side)

☐ 7A. <u>D1 (colored LED) on the Bottom side.</u> Install D1 (the full-color RGB LED) from the bottom side and solder it in place. Orientation of this component is critical because it is made up of polarized diode elements. Note that the LED has a flat side to help you with its orientation. This flat side should be mounted in the same direction as indicated on the silkscreen layout and the parts layout diagram (flat side toward R1).

☐ 8A. Install R1, a 680 ohm resistor (Marked 681).

☐ 9A. Install R2, a 51 ohm resistor (Marked 510).

<div align="center">OR</div>

☐ 7B. <u>D1 (colored LED) on the Top side.</u> Install D1 (the full-color RGB LED) from the top side and solder it in place (make sure to leave the leads long enough so that you can top solder it). Orientation of this component is critical because it is made up of polarized diode elements. Note that the LED has a flat side to help you with its orientation. This flat side should be mounted in the same direction as indicated on the silkscreen layout and the parts layout diagram by the dashed line (flat side toward J1 & J2).

☐ 8B. Install R1, a 51 ohm resistor (Marked 510).

☐ 9B. Install R2, a 680 ohm resistor (Marked 681).

OPTIONAL JUMPER PLACEMENT

☐ 10. The mounting of J1 and J2 is another choice left to you. They are used to select the speed settings of the color change and blink versus fade mode operations. When you momentarily close the contacts together, they tell the micro-controller what to do. The unit is programmed by default for a fairly fast color changing speed (in fade mode) so you may opt to save space and not even install them! If you choose to install them on the back side of the board you can easily solder the leads. Mounting them on the silkscreened top side requires lifting them off the board a bit so you can top solder them. Install J1 and J2 if desired.

FINAL COMPONENTS

☐ 11. Install C2, one of the 1 uF electrolytic capacitors. These capacitors (like most electrolytics) are polarity sensitive so pay close attention to the markings. Notice how the positive side of the capacitor's plastic base has small beveled corners? These bevels help to indicate the proper orientation of the part. Match these edges with the markings on the silk screen of the board to ensure correct positioning.
As discussed in the pre-assembly steps, tinning one of the circuit board

pads before the part installation makes mounting it a lot easier. Set the lead of the part on the tinned pad, reheat it, now let the capacitor drop down into the melted solder. Finish up by soldering the other lead and making sure both solder joints look good.

☐ 12. Install C3, the other 1 uF electrolytic capacitor (again watch the polarity). These capacitors help to smooth out the power supply voltage so that any glitches will not confuse the micro-controller and cause problems.

☐ 13. Install C1, a 0.1 uF ceramic surface mount capacitor. Unfortunately this capacitor is unmarked, like most small ones of this type. It's a good idea to keep all SMT components in their original containers in order to make identification easier later down the line.

☐ 14. Now for your power connection. Install the 9V battery clip. Solder the Red lead in the hole with the + marking and the Black lead into the other hole (the one with a lot of copper around it close to the B1 label). If you plan on using an alternate power source, make sure you use the proper polarity as described above.

FINISHED!!

Ok, I bet you are excited to go and plug the battery right in but please don't do it yet! We need to inspect our work to make sure we did everything correctly. We don't want to destroy any of our parts after all!

Check the two electrolytic capacitors for correct orientation. Make sure the beveled plastic bases are in the same orientation as shown in the parts layout and the silkscreen.

Check the two ICs to make sure they are in the correct orientation. Pin 1 had better line up with the pin one marking on the silk screen! If they are installed incorrectly, we'll need to fix them. There is a risky but effective way to de-solder small SMT ICs like these:

• Use quite a bit of solder to cover all 4 leads on one side of the part (effectively shorting them all together). While the solder is still molten on all four leads, use a pick or your tweezers to gently bend this side away from the PC board a bit. Don't use too much pressure or you'll peel the traces of the other side right off the circuit board!!!

• Re-heat and use a solder sucker or wick to clean off the excess solder. Be very careful with these delicate traces if you use a solder sucker. If you use braid or wick simply hold it in place to remove the solder; sliding the wick around on top of the pads tends to remove them from the board!

- Do the same for the other side, only pick the part off the board this time with the tweezers when the solder is molten.

- Use the solder sucker or wick again to clean off the board and any excess solder left on the components pins.

- Reposition and re-solder your part to the board.

USING THE SBRGB

There isn't much to be done after you have inspected the board. Simply clip on the battery and enjoy the show! You should be able to see the full-color LED cycle through all the colors of the rainbow in succession. If you don't, one of the elements may not be properly soldered or the LED was installed with the wrong orientation.

To use your SBRGB, short across the pins of J1 (faster) or J2 (slower) to change the speed of the color cycle. When the speed changes, the LED will flash indicating a speed change command was received.

The mode selection, Fade or Blink, is chosen by simultaneously shorting both J1 and J2. The LED will turn a solid color Red or Green (depending on which side of the board you mounted it on) to indicate that the command has been received and the mode of operation will toggle from one mode to the other.

Play around with the jumper settings and have fun. You will quickly become entranced by the swirling effect of the color changes!

PROJECT IDEA

 A really neat feature of LEDs is their ability to switch on and off very fast. Our Super Blinky is doing this faster than the eye can see for all three colors. A neat thing to try is putting the Super Blinky on the end of a strong string or pair of wires (so you don't have to suspend the battery) and spin it around quickly. You should be able to clearly see the pulse width modulation of the three colors spread out before you!

SBRGB PARTS LAYOUT DIAGRAM
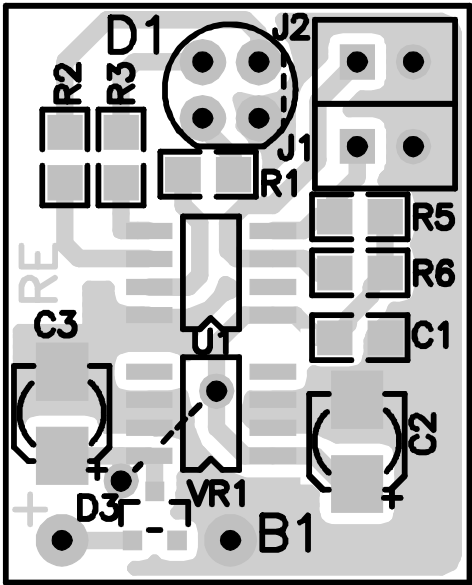
TROUBLESHOOTING GUIDE

If your Super Blinky does not work at all, re-check the following:

- Correct orientation of U1, VR1, D1 (the LED), and battery hookup.

- Correct polarity of the electrolytic capacitors.

- Correct placement of D3.

- Use an eye loupe to closely examine your parts placement for any pins that may have overlapped two pads, solder joints that could be open, or any large blobs of solder that maybe short across two or more pins.

- Correct battery installation, and a good battery.

- Replacement parts may be ordered directly from Ramsey Electronics, Inc. First read the warranty in the back of the manual before you send your unit back.

SBRGB SUPER BLINKY SPECIFICATIONS

- Input working voltage between 6 - 12 VDC @ 25 mA average (40 mA pk). NOTE: 6 volt operation requires use of a jumper and removal of VR1.

- PCB Dimensions: 1.025" L x 0.825" W (max component height: 1/2")

- Weight: 0.2 oz

- RGB LED (DIS-1024-105A): specifications on page 8

- Micro-controller type: PIC12C509SN (pre-programmed)
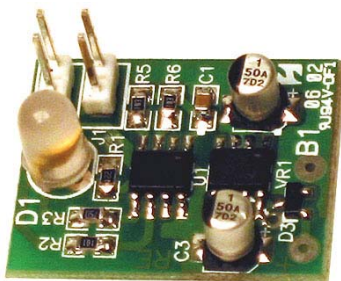
The Ramsey Kit Warranty

Please read carefully BEFORE calling or writing in about your kit. Most problems can be solved without contacting the factory.

Notice that this is not a "fine print" warranty. We want you to understand your rights and ours too! All Ramsey kits will work if assembled properly. The very fact that your kit includes this new manual is your assurance that a team of knowledgeable people have field-tested several "copies" of this kit straight from the Ramsey Inventory. If you need help, please read through your manual carefully. All information required to properly build and test your kit is contained within the pages!

1. DEFECTIVE PARTS: It's always easy to blame a part for a problem in your kit, Before you conclude that a part may be bad, thoroughly check your work. Today's semiconductors and passive components have reached incredibly high reliability levels, and it's sad to say that our human construction skills have not! But on rare occasions a sour component can slip through. All our kit parts carry the Ramsey Electronics Warranty that they are free from defects for a full ninety (90) days from the date of purchase. Defective parts will be replaced promptly at our expense. If you suspect any part to be defective, please mail it to our factory for testing and replacement. Please send only the defective part(s), not the entire kit. The part(s) MUST be returned to us in suitable condition for testing. Please be aware that testing can usually determine if the part was truly defective or damaged by assembly or usage. Don't be afraid of telling us that you 'blew-it', we're all human and in most cases, replacement parts are very reasonably priced.

2. MISSING PARTS: Before assuming a part value is incorrect, check the parts listing carefully to see if it is a critical value such as a specific coil or IC, or whether a RANGE of values is suitable (such as "100 to 500 uF"). Often times, common sense will solve a mysterious missing part problem. If you're missing five 10K ohm resistors and received five extra 1K resistors, you can pretty much be assured that the '1K ohm' resistors are actually the 'missing' 10 K parts ("Hum-m-m, I guess the 'red' band really does look orange!") Ramsey Electronics project kits are packed with pride in the USA. If you believe we packed an incorrect part or omitted a part clearly indicated in your assembly manual as supplied with the basic kit by Ramsey, please write or call us with information on the part you need and proof of kit purchase.

3. FACTORY REPAIR OF ASSEMBLED KITS:
To qualify for Ramsey Electronics factory repair, kits MUST:
1. NOT be assembled with acid core solder or flux.
2. NOT be modified in any manner.
3. BE returned in fully-assembled form, not partially assembled.
4. BE accompanied by the proper repair fee. No repair will be undertaken until we have received the MINIMUM repair fee (1/2 hour labor) of $25.00, or authorization to charge it to your credit card account.
5. INCLUDE a description of the problem and legible return address. DO NOT send a separate letter; include all correspondence with the unit. Please do not include your own hardware such as non-Ramsey cabinets, knobs, cables, external battery packs and the like. Ramsey Electronics, Inc., reserves the right to refuse repair on ANY item in which we find excessive problems or damage due to construction methods. To assist customers in such situations, Ramsey Electronics, Inc., reserves the right to solve their needs on a case-by-case basis.

The repair is $50.00 per hour, regardless of the cost of the kit. Please understand that our technicians are not volunteers and that set-up, testing, diagnosis, repair and repacking and paperwork can take nearly an hour of paid employee time on even a simple kit. Of course, if we find that a part was defective in manufacture, there will be no charge to repair your kit (But please realize that our technicians know the difference between a defective part and parts burned out or damaged through improper use or assembly).

4. REFUNDS: You are given ten (10) days to examine our products. If you are not satisfied, you may return your unassembled kit with all the parts and instructions and proof of purchase to the factory for a full refund. The return package should be packed securely. Insurance is recommended. Please do not cause needless delays, read all information carefully.

SUPER BLINKY SMT PRACTICE KIT
Quick Reference Page Guide

REQUIRED TOOLS

- Soldering Iron Ramsey WLC100
- Thin Rosin Core Solder Ramsey RTS12
- Needle Nose Pliers Ramsey MPP4 or RTS05
- Small Diagonal Cutters Ramsey RTS04

<OR> Technician's Tool Kit TK405

ADDITIONAL SUGGESTED ITEMS

- Holder for PC Board/Parts Ramsey HH3
- Desoldering Braid Ramsey RTS08
- Digital Multimeter Ramsey M133

Price: $5.00
Ramsey Publication No. MSBRGB
Assembly and Instruction manual for:
RAMSEY MODEL NO. SBRGB

TOTAL SOLDER POINTS
45
ESTIMATED ASSEMBLY TIME

Beginner .... 2 hrs
Intermediate .... 1 hrs
Advanced............. 0.5 hrs

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